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OPERATING EXPERIENCE WEEKLY SUMMARY

Office of Nuclear and Facility Safety

March 13 through March 19, 1998

Summary 98-11

Operating Experience Weekly Summary 98-11

March 13 through March 19, 1998

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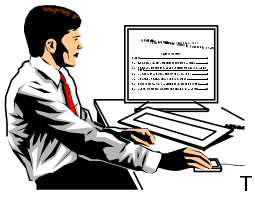

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EVENTS

1. INADEQUATE PROCEDURE CAUSES SHUT-DOWN OF DISSOLVER

On March 13, 1998, at the Savannah River F-Canyon Facility, an operator closed a valve that isolated a blower from a dissolver causing a momentary drop in off-gas flow. The drop in off-gas flow activated an interlock that isolated steam to the dissolver. The operator placed the dissolver in a safe configuration when he received the interlock alarm. Investigators determined that the operator's procedure was inadequate in that it directed him to close a valve that should have remained open. Procedure writers had not adequately verified the procedure steps for the existing dissolver configuration, which was in an infrequently used lineup. Failure to validate and verify procedures before they are authorized for use creates the potential for equipment shut down, equipment damage, injury, and unanalyzed events. (ORPS Report SR--WSRC-FCAN-1998-0013)

The operator was performing a valving evolution to start up a blower to provide vacuum to one of two operating dissolvers. The procedure required the operator to start the blower in a recirculation mode before aligning it to the dissolver. At the time of the event, another blower was providing vacuum to the two dissolvers by way of a cross-connect valve. The operator planned to separate the dissolvers so that each one was supported by its own blower. A procedure step directed the operator to close the cross-connect valve, effectively isolating one of the dissolvers from the blower. This caused a momentary drop in off-gas flow, activation of the off-gas interlock, and isolation of steam to the dissolver. A stack jet automatically returned the off-gas flow rate to normal. The off-gas interlock ensures that there is sufficient off-gas flow to keep any hydrogen that could evolve from an aluminum/nitric acid reaction below its lower flammability limit.

Investigators determined that, although the procedure worked for other configurations, it was not verified and validated for this dissolver lineup. A desk-top review of the procedure and system configuration by engineers and subject matter experts would have identified that closing the cross-connect valve would result in a drop in off-gas flow and actuation of the interlock as required by the operational safety requirement.

A similar event occurred at F-Canyon on March 1, 1991, when an operator closed a valve upstream of a blower, placing the blower in recirculation mode. Closing this valve resulted in the loss of vacuum in the dissolver. Investigators determined that the procedure the operator was following was adequate, but he unknowingly followed steps in the wrong section of the operating procedure. Investigators determined that inattention to detail on the part of the operator was both the direct and root cause of the event. (ORPS Report SR--WSRC-FCAN-1991-0034)

NFS has reported numerous events involving inadequate procedures in the Weekly Summary. Following are some examples.

- Weekly Summary 97-12 reported that a fuel handler at the Brookhaven Medical Research Reactor completed and signed written fuel-handling procedure steps without noticing the steps contained errors. The fuel handler completed the fuel-handling operation correctly without following the procedure. Corrective actions included (1) revising the procedure to include sign-offs for each significant step, (2) stressing the importance of adequate verification and validation of written procedures, and (3) reviewing and assessing procedure development controls. (ORPS Report CH-BH-BNL-BMRR-1997-0001)

- Weekly Summary 97-08 reported that process specialists at the Rocky Flats Environmental Technology Site found a valve in the wrong position while draining plutonium nitrate solution from a process tank. The valve, which had criticality safety implications, was not identified in the procedure for draining the tank. This procedure inadequacy affected the sampling process and the movement of the plutonium nitrate solutions. (ORPS Report RFO--KHLL-771OPS-1997-0009)

- Weekly Summary 97-04 reported that an operator at the Savannah River F-Canyon backflushed a sampler unit with 4.1 percent nitric acid instead of domestic water after sampling a vessel. The acid and carbonate mixture reacted in the sampler lines and spread contamination onto the floor of the sampler box. The sample procedure did not specify the correct flushing solution or warn of possible chemical reactions. (ORPS Report SR--WSRC-FCAN-1997-0003)

- Weekly Summary 96-48 reported that an operator performing a valve lineup on an instrument air dryer at the West Valley Site closed a bypass valve before opening the supply air valve and caused the loss of the main plant process ventilation system. The operator used the correct procedure; however, the procedure was inadequate in that it did not give a specific, sequenced valve lineup. (ORPS Report OH-WV-WVNS-1996-0012)

OEAF engineers searched the ORPS database from 1990 to present for occurrences reported under Nature of Occurrence category 01F (Violation/Inadequate Procedures) and found 3,684 occurrences. Personnel error contributed to 42 percent of the root causes reported by facility managers for this category and procedures not used or used incorrectly accounted for 49 percent of the personnel errors. Figure 1-1 shows the distribution of root causes for violation/inadequate procedures.

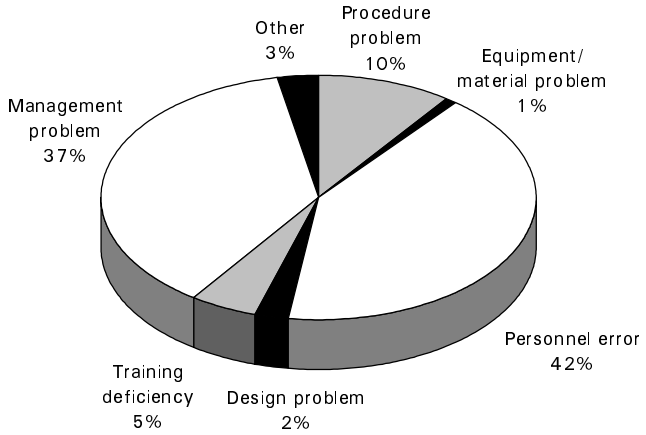

Figure 1-1. Root Causes for Violation/Inadequate Procedures[1]

[1] OEAF engineers searched the ORPS database from 1990 through 03/18/98 using the graphical user interface for occurrences reported under Nature of Occurrence category 01F (Violation/Inadequate Procedures) and found 3,655 reports with 3,684 occurrences.

These events underscore the importance of verifying and validating procedures, using procedures, and following them step-by-step. Workers must assume responsibility for their work, pay attention to detail, and adhere to procedures and instructions. DOE 5480.19, *Conduct of Operations Requirements for DOE Facilities*, chapter XVI, "Operations Procedures," states that operations procedures provide direction to ensure that the facility is operated safely and within its design basis. Attention should be given to writing, reviewing, and monitoring operations procedures to ensure the content is technically correct and the wording and format are clear. As stated in the Order, "Procedures should be developed for all anticipated operations, evolutions . . . and . . . should provide administrative and technical direction to conduct the intent of the procedure effectively. Sequence of procedure steps should conform to the normal or expected operational sequence."

DOE-STD 1029-92, *Writers Guide For Technical Procedures*, provides guidance to assist procedure writers across the DOE complex in producing accurate, complete, and usable procedures that promote safe and efficient operations. Inputs to procedures should be obtained from operators and training personnel. Section 2.3, "Facility Configuration," requires walk-downs, simulations, modeling, or desk-top reviews to ensure procedures are technically accurate and adequate. Verification and validation of procedures should not only ensure that the correct equipment and components are identified, but should also consider the effect on system operation from changing their status. Verifiers should evaluate the change in magnitude and direction of system parameters for consistency with what is expected.

KEYWORDS: operating procedures, validation, valve

FUNCTIONAL AREAS: Procedures, Operations

2. WORKERS SPLASHED WITH CAUSTIC SOLUTION DURING DECOMMISSIONING ACTIVITIES

On March 11, 1998, at the Oak Ridge Y-12 Site, two maintenance workers were removing abandoned piping when liquid lithium hydroxide unexpectedly sprayed on them. They stopped work, washed with soap and water to remove the solution, and informed an area supervisor of the event. Medical staff personnel examined the workers, determined that they were uninjured, and released them. Investigators determined that the maintenance workers sawed the pipe at a low point causing approximately 3 gallons of lithium hydroxide to spill out. Investigators believe that the lithium hydroxide had solidified at each end of the low point, allowing the solution in the center to remain liquid. Liquid lithium hydroxide is highly corrosive and can burn the skin and eyes and cause severe irritation to the ears, nose, and throat. Failure to adequately characterize the pipe contents before removing it led to workers being exposed to liquid lithium hydroxide. (ORPS Report ORO--LMES-Y12SITE-1998-0012)

Investigators determined a maintenance supervisor performed a walk-down to determine potential hazards during the work-planning stage of the job. He knew that the pipe might hold solidified lithium hydroxide, so he included personnel protective equipment (gloves and safety glasses) requirements in the work package. The supervisor did not consider the hazards of liquid lithium hydroxide because the system had been abandoned and open to the atmosphere for approximately 30 years, and he assumed that any liquid had evaporated. However, no one confirmed this assumption before beginning work. The facility manager directed facility personnel to further review this event and develop corrective actions.

NFS has reported similar events in several Weekly Summaries. Following are some examples.

- Weekly Summary 98-10 reported that an operator at the Oak Ridge Environmental Restoration Facility was removing a blank flange from an isolated low-level liquid waste transfer line to add a termination box, and contaminated liquid sprayed from the flange. No personnel were contaminated, but the internal surface of the concrete containment basin, a valve box, and a 1-square-foot area outside the basin were contaminated to levels of 14 mrad/hr beta-gamma and 65,000 dpm/100 cm^2 alpha. Supervisors had anticipated the potential for residual liquid, but did not completely plan for the pressurization of the liquid at the piping low point. (ORPS Report ORO--LMES-X10ENVRES-1998-0002)

- Weekly Summary 96-18 reported that two pipefitters at the Savannah River Site were sprayed with a 50 percent sodium hydroxide solution when cutting a transfer line from a tank. When the pipefitters made a cut in the pipe near a low point that was hidden by lagging, the sodium hydroxide spilled out causing minor skin irritation. The 30-foot-long pipe had a 3-inch dip near the middle that provided an area for solution to accumulate. Operators had drained and flushed the tank, but were unable to flush the transfer line. Investigators determined that supervisors did not identify the potential for residual solution in the line and did not discuss the hazards of caustic solutions. (ORPS Report SR--WSRC-FCAN-1996-0006)

These events illustrate the importance of characterizing the contents of previously abandoned systems or equipment before work commences. In order to safely accomplish this, personnel should perform hazards analyses and sample the system contents to determine both chemical and radiological contents. When removing systems or components that have not been used for years, past facility operations and missions should not be solely relied on because many materials can become unstable or unsafe over time, and available documentation of the system usage may not be complete. It may become necessary for experienced personnel and subject matter experts to assist in these efforts from the outset. For this event, engineered methods (such as installation of self-tapping, isolable, low-point drains) could have been used to confirm the supervisor's assumption that there was no liquid in the pipe before work began.

Chemicals found at facilities in shut-down, transition, or deactivation mode may present other hazards in addition to those typically found in active facilities. Chemicals remaining in shut-down vessels, piping systems, drums, or storage locations may be subject to long-term changes because of degradation or concentration, thereby increasing the associated hazards. OEAF engineers recommend that cognizant facility personnel assess the condition of chemicals subject to potential long-term storage, even though the safety of the active process has been analyzed and assured. Long-term changes could lead to spontaneous reactions such as corrosion-product catalyzed reactions, slow chemical degradation, concentration by evaporation, or inadvertent cross-contamination caused by system leaks or misrouting of transfers.

The following DOE and industry documents provide valuable guidance for personnel who may encounter hazardous chemicals as a result of decontamination or decommissioning work.

- DOE-HDBK-1100-96, *Chemical Process Hazards Analysis,* February 1996, and DOE-HDBK-1101-96, *Process Safety Management for Highly Hazardous Chemicals,* February 1996, provide guidance for DOE contractors managing facilities and processes covered by the Occupational Safety and Health Administration Rule for Process Safety Management of Highly Hazardous Chemicals (29 CFR 1910.119). Both handbooks are available on the Department of Energy Technical Standards Home Page at URL http://www.doe.gov/html/techstds/standard/standard.html.

- DOE/EM-0142P, *Decommissioning Handbook*, chapter 7, "Characterization," provides guidance for methods to develop sampling and analysis plans. Section 7.2.4 describes sampling and measurement characterization tools for solids, liquids, and gases. Chapter 10, "Dismantling, Segmenting, and Demolition," provides detailed descriptions of dismantling and segmenting techniques. Chapter 12, "Worker Protection," provides guidance for personnel protection and monitoring for exposures to inhalation, skin contact, trauma, heat, and cold.

KEYWORDS: chemicals, chemical safety, vulnerability studies

FUNCTIONAL AREAS: Chemistry, Industrial Safety, Decontamination and Decommissioning

3. ACCESS CONTROL PROBLEMS IDENTIFIED AT HANFORD

This week, OEAF engineers reviewed two events at the Hanford Site, where workers with expired qualifications were allowed to enter radiologically controlled areas because of incorrect information in the site-wide Access Control Entry System (ACES). The ACES is an automated system used to track radiological and hazardous waste work package requirements and worker radiological and hazardous waste safety training. The system ensures that training has been completed and is current before workers enter areas that require such training. On March 9, 1998, at the Fast Flux Test Facility, a radiation control technician granted a thermal insulation worker access to a radiologically controlled area based on erroneous data in the ACES. The ACES administrator failed to update the system when Training personnel informed him that the insulator had failed a module of the computer-based training for Radiation Worker II requalification on March 3, 1998. On March 12, 1998, at the Pacific Northwest National Laboratories, personnel in the radiochemical processing group discovered that Radiation Worker II qualifications for a worker had expired on February 28, 1998. The worker had been entering radiologically controlled areas after his qualifications had expired because information in the ACES indicated that his training had not yet expired. Although there was no personnel contamination or any spread of contamination as a result of these events, poor administrative control of the ACES led to unqualified workers entering radiologically controlled areas. Expired training can lead to a decrease in worker proficiency and knowledge and may result in an adverse impact on the environment and on the safety of personnel. (ORPS Reports RL--PHMC-FFTF-1998-0005, RL--PNNL-PNNLNUCL-1998-0002)

Investigators determined that unqualified workers were able to enter radiologically controlled areas based on erroneous information in the ACES. They also determined that both workers violated radiological work permit requirements because the work permits required the workers to have current Radiological Worker II training as a prerequisite for entry. They determined that procedures require workers to read (and ensure that they comply with) the radiological work permit before performing work. Investigators are trying to determine why the ACES administrator failed to update data in the system.

NFS has reported occurrences involving expired qualifications in several Weekly Summaries. Following are some examples.

- Weekly Summary 97-05 reported that a waste generating custodial officer at the Savannah River Site FB-Line discovered that the annual Resource Conservation and Recovery Act (RCRA) training for six waste-handling operators had expired. While conducting an internal audit of RCRA training qualifications, the officer found the operators had performed RCRA-related waste handling activities after their annual training expired. (ORPS Report SR--WSRC-FBLINE-1997-0006)

- Weekly Summary 96-50 reported that Manufacturing Division personnel at the Pantex Plant identified a production technician who had performed work without being fully qualified. The technician lacked courses on general work practices required by plant procedures. (ORPS Report ALO-AO-MHSM-PANTEX-1996-0236)

- Weekly Summary 95-31 reported that a shift manager performed work at the Hanford Plant with an expired certification. Investigators found that certifications had expired or were about to expire for 50 percent of the shift managers. DOE granted a 90-day extension to allow re-certification of the shift managers. Corrective actions included providing a status report that identifies re-certification training needs 60 days before expiration. (ORPS Report RL--WHC-PFP-1995-0040)

OEAF engineers searched the ORPS database for events involving expired qualifications and found 41 reports. Figure 3-1 shows the distribution of root causes for these occurrences. A review of these occurrences shows that managers reported management problem as the root cause in 65 percent of the occurrences for which a root cause was identified. The root cause of 52 percent of these occurrences was identified as inadequate administrative control; 24 percent were attributed to policy not adequately defined, disseminated, or enforced.

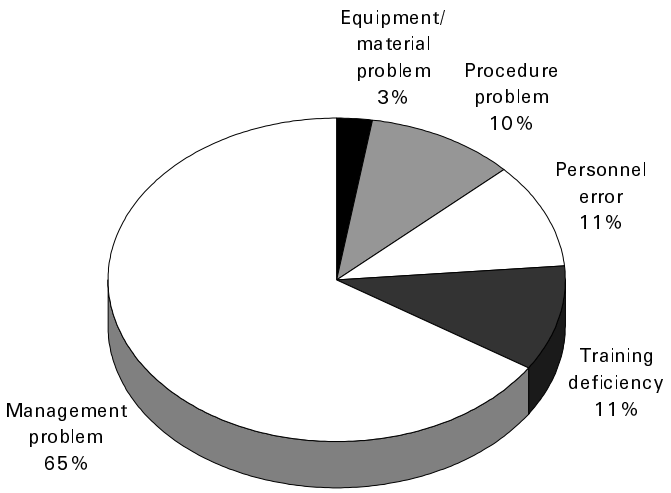

Figure 3-1. Root Causes for Expired Qualifications Occurrences[2]

These events illustrate the need for training coordinators, facility managers, and access control system administrators to review their training program records and controls to ensure that staff are qualified and certified for the tasks to which they are assigned. Employees should also accept the responsibility for meeting qualification requirements. Supervisors should be able to easily track the status of training for workers so that training can be scheduled in an effective manner.

- DOE 5480.20, *Personnel Selection, Qualification, Training, and Staffing Requirements at DOE Reactor and Non-Reactor Nuclear Facilities,* provides requirements for ensuring that all workers are qualified to carry out their assigned responsibilities. Chapter I, section 7.a.(1) and 7.a.(2), provide requirements for developing and maintaining training to meet the position requirements. Requirements for initial and continuing training can be found in sections I.7.c and I.7.d.

- DOE EH-0256T, *Radiological Control Manual,* section 122, states: "Minimizing worker radiation exposure can be achieved only if all persons involved in radiological activities have an understanding of and the proper respect for radiation." Section 123 provides specific guidance on radiological worker responsibilities. Managers at facilities with radiation areas should review their programs to ensure that workers are aware of and comply with this guidance.

- 10 CFR 835.902, *Radiological Workers*, states that radiological worker training programs and retraining shall be established and conducted at intervals not to exceed 2 years to familiarize the worker with the fundamentals of radiation protection and the ALARA (As Low As Reasonably Achievable) process. Training shall include both classroom and applied training.

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[2] OEAF engineers searched the ORPS database using the graphical user interface for all narrative containing (expire* or lapse*)<NEAR/6>(train* or qualif*) and not facility FEMP. All FEMP occurrences with narrative satisfying this search string are nearly identical reports on controlled substance violations. Based on a random sampling of 20 events, OEAF engineers determined that each slice is accurate to within ± 5 percent.

- DOE-STD-1060-93, *Guide to Good Practices for Continuing Training*, chapter 7, requires auditable records of personnel training. It also states that supervisors "should have access to qualification records, as necessary, to support the assignment of work to qualified personnel."

KEYWORDS: access control, administrative control, radiological work permit, training and qualifications

FUNCTIONAL AREAS: Radiation Protection, Training and Qualification

4. INADVERTENT ACTUATION OF FIRE PROTECTION DEMISTER SPRAY

On March 9, 1998, at the Los Alamos National Laboratory Plutonium Processing and Handling Facility, fire alarm maintenance personnel were restoring power to a fire alarm panel when a demister spray sprinkler head in a ventilation exhaust duct actuated and sprayed water into the duct work. The sprinkler head activated for approximately 4 seconds and sprayed 2 gallons of water into the exhaust duct. The demister spray is designed to cool any hot gases exhausted during a fire before they reach the high-efficiency particulate air filters. Investigators determined that relays in an auxiliary relay panel installed during a 1996 upgrade unexpectedly changed state and sent the actuation signal. There was no release of contamination from the exhaust plenum cool-down box during the sprinkler activation. This event is significant because fire alarm personnel were unaware of the configuration of the auxiliary relay panel and the procedure for restoring power to prevent actuation of the demister sprays. Inadvertent actuation of fire suppression systems can result in unnecessary equipment damage (e.g., degradation of filters), spread of contamination, and system unavailability during actual emergencies. (ORPS Report ALO-LA-LANL-TA55-1998-0007)

Facilities Management personnel heard an unusual noise coming from the main fire alarm panel and noticed that the panel signaled an internal failure. They immediately requested that fire alarm maintenance personnel investigate the problem. Fire alarm maintenance personnel discovered a defective battery charger and de-energized the fire alarm panel to replace it. When they re-energized the panel, the facility control system and the fire alarm panel received heat detector alarms from nearly all fire zones. Because the fire panel was in a maintenance mode, it did not send a fire alarm to the fire station. However, the facility control system interpreted the signals from the heat detectors in the exhaust plenum as a fire and actuated the demister spray.

Investigators determined that during the facility control system upgrade in late 1996, installers added an auxiliary relay panel between the fire alarm panel and the facility control system. When the fire alarm personnel re-energized the fire alarm panel, the relays in the auxiliary panel unexpectedly changed state, and sent the signal to the facility control system. Testing of the fire alarm signals after the battery charger was replaced also indicated that when a signal was sent to the demister spray, a signal from the first stage high-efficiency particulate filter spray was received.

On March 10, maintenance personnel repaired and re-installed the faulty battery charger because the replacement charger was stuck in a high-rate-of-charge condition. When they replaced the original battery charger, they de-energized the panel again. However, before they re-energized it, they placed the facility control system in the monitor mode to prevent any actuation signals. The facility manager conducted a critique of the event. Critique members determined that this situation represented an inadequate procedure because the procedure for cold start-up of the fire alarm panel did not contain steps to place the facility control system in the monitor mode. See Article 1 for related information on inadequate procedures.

NFS reported the actuation of a plenum deluge system in Weekly Summary 97-37. Alarm technicians at the Rocky Flats Environmental Technology Site inadvertently actuated the plenum deluge system while performing an annual battery load-test on a fire panel. The deluge system released 2,000 gallons of water into the plenum, and 500 gallons of water leaked from the plenum into adjacent contamination areas. Investigators determined that the technicians used a generic procedure, supplemented by an uncontrolled list of the associated systems connected to the tested alarm points. When the technicians actuated an alarm on the fire panel, the alarm point also actuated the deluge system. Because they did not isolate the alarm before the test, the deluge system received the actuation signal. Investigators also determined that the technicians failed to isolate the plenum deluge system because it was not identified on the list and that they considered the battery load-test to be a routine task. Therefore, they did not conduct a pre-job brief, which would have allowed the operations manager to review the job to determine any potential effects to the facility. (ORPS Report RFO--KHLL-NONPUOPS1-1997-0009)

The Los Alamos event underscores the need for strong controls for testing and documenting facility upgrades and modifications. The event brings into question the level of configuration control and testing used by facility personnel during the upgrade of the facility control system. Detailed system testing would have identified the issue with the relays and the need to revise procedures to allow restoration of the fire protection system without causing an inadvertent actuation.

DOE 5480.19, *Conduct of Operations Requirements for DOE Facilities*, chapter VIII, “Control Of Equipment and System Status,” states that DOE facilities are required to establish administrative control programs to handle configuration changes resulting from maintenance, modifications, and testing activities. DOE-STD-1073-93, *Guide for Operational Configuration Management Program, Including the Adjunct Programs of Design Reconstitution and Material Condition and Aging Management, Parts 1 and 2,* addresses the modification technical reviews needed as part of the change control element. The standard also discusses the control of modifications that can lead to temporary or permanent changes in design requirements, facility configuration, or facility documentation. The standard discusses identifying changes, conducting technical and management reviews, and implementing and documenting changes. Change management is the process of maintaining the configuration of safety requirements, procedures, and controls in agreement with the mission and facility design configuration. The standard states that physical configuration assessments or walk-downs should be performed for representative sample structures, systems, and components within the facility to determine the degree of agreement between the physical configuration and the configuration on the facility documentation. Physical walk-downs should be included as part of the programmatic assessments conducted during initial assessments, post-implementation assessments, and periodic effectiveness assessments.

KEYWORDS: configuration control, battery charger, fire protection, plenum, sprinkler, testing

FUNCTIONAL AREAS: Configuration Control, Fire Protection

5. URANIUM FIRE AT ARGONNE NATIONAL LABORATORY—WEST

On March 13, 1998, at the Argonne National Laboratory—West Fuels Manufacturing Facility, a technician was consolidating cans of passivated uranium hydride in an air atmosphere glovebox and opened one can, resulting in a spark that caused a fire in both cans. The technician poured MET-L-X powder (a fire extinguishing agent) on the fire to extinguish it, exited the area, and notified fire department personnel. Fire department personnel responded to the event and confirmed that the fire was extinguished. Recovery team personnel verified that containment integrity remained intact and radiological contamination was not spread outside of the glovebox. They also checked ventilation ducts for thermal hot-spots and collected, repackaged, and moved the remaining uranium hydride to an inerted glovebox. Investigators determined that 1.5 to 1.7 kg of uranium hydride were involved in this event. They also determined that the technician had successfully consolidated 13 cans before the fire started. Uranium hydride is passivated by exposing it to a dilute oxygen atmosphere to slowly oxidize it to allow safe handling in a normal air atmosphere. The facility manager suspended all work with uranium powder until the cause of this event can be determined. DOE has assembled an accident investigation team to review this event. OEAF engineers will follow the investigation and provide information about the causes, corrective actions, and lessons learned in a future Weekly Summary. (ORPS Report CH-AA-ANLW-FMF-1998-0001)

NFS has reported numerous events about pyrophoric materials in the Weekly Summary. Following are some examples.

- Weekly Summary 97-48 reported that facility managers at the Hanford Site Plutonium Finishing Plant determined that an unreviewed safety question existed after they reviewed a photograph of an unexpected reaction that occurred when operators opened a plutonium storage can. On December 23, 1996, operations personnel noticed a spark when they opened a plutonium storage can inside a glovebox. They had observed similar reactions before and believed they were caused by a statically induced spark; however, this time the reaction was captured on videotape. On May 30, 1997, facility personnel reviewed a still photograph made from the videotape and determined that the reaction seemed to be a flash of fire rather than a statically induced spark. Based on the photograph and technical reviews, technical support personnel determined that a pressure excursion, large enough to blow out a glovebox window, could occur when the storage cans are opened. Investigators believe that this event was caused by air reacting with plutonium hydride inside the can. Corrective actions included designing a can that can be opened in a safe and controlled manner without producing static. (ORPS Report RL--PHMC-PFP-1997-0027)

- Weekly Summary 97-07 reported that a machine shop operator at Lawrence Livermore National Laboratory ignited a pile of depleted uranium chips when he created a spark with a hand-file while removing a burr on a depleted uranium part. The fire was contained within a bandsaw enclosure. (ORPS Report SAN--LLNL-LLNL-1997-0010)

- Weekly Summary 95-24 and 92-36 reported events involving fires caused by a pyrophoric reaction of lithium and water at the Lawrence Berkeley Laboratory. (ORPS Report SAN--LBL-EED-1995-0001, SAN--LBL-EHS-1992-0012)

These events illustrate the importance of using caution when working with processes involving pyrophoric metals. Personnel involved with such activities should fully understand the potential reactions associated with materials used in the process. Hazards that could cause or contribute to the severity of a combustible metal fire should be identified by a hazard analysis, and measures to minimize the hazards should be implemented.

The following documents provide useful information about handling, packaging, and storing of pyrophoric materials.

- DOE-STD-3013-96, *Criteria for Preparing and Packaging Plutonium Metals and Oxides for Long-Term Storage,* provides a summary of packaging and storage criteria for plutonium metals. It states that plutonium materials must be in stable forms and packaged in containers designed to maintain their integrity under normal storage conditions and during anticipated handling accidents. A copy of the Standard is available on the internet at URL http://www.doe.gov/html/techstds/standard/standard.html.

- DOE-HDBK-1081-94, *Primer on Spontaneous Heating and Pyrophoricity*, provides information for the identification and prevention of potential spontaneous combustion hazards. The handbook contains information on the effects that atmospheric oxygen, moisture, heat transfer, and specific areas have on spontaneous heating and ignition. It also identifies metals and gases known to be pyrophoric, acceptable methods for long-term storage, proper extinguishing agents (such as Met-L-X), and additional sources of reference materials available on these subjects. The handbook can be obtained by accessing the Internet at URL http://www.doe.gov/html/techstds/standard/standard.html.

- National Fire Protection Association, *Fire Protection Handbook*, chapter 4-16, "Metals," provides guidance on the fire hazard properties of combustible metals including uranium. It states that uranium is subject to spontaneous ignition and that fires have occurred spontaneously after prolonged exposure to moist air. Ordering information for NFPA documents may be found at the NFPA Home Page located at URL http://www.nfpa.org.

The *Hazard and Barrier Analysis Guide*, developed by OEAF, discusses barriers that provide controls over hazards associated with a job. Barriers may be physical barriers, procedural or administrative barriers, or human action. The reliability of barriers is important in preventing undesirable events such as fires. The reliability of a barrier is determined by its ability to resist failure. Barriers can be imposed in parallel to provide defense-in-depth and to increase the margin of safety. The *Hazard and Barrier Analysis Guide* provides a detailed analysis for selecting optimum barriers, including a matrix that displays the effectiveness of different barriers in

protecting against some common hazards. A copy of *The Hazard and Barrier Analysis Guide* is available at URL http://tis.eh.doe.gov:80/web/oeaf/tools/hazbar.pdf.

KEYWORDS: uranium, fire, pyrophoric materials

FUNCTIONAL AREAS: Hazards Analysis, Operations

PRICE ANDERSON AMENDMENTS ACT (PAAA) INFORMATION

1. PRELIMINARY NOTICE OF VIOLATION FOR FAILURE TO PROTECT WORKERS

On March 9, 1998, the DOE Office of Enforcement and Investigation issued a Preliminary Notice of Violation under the Price-Anderson Amendments Act to Lawrence Livermore National Laboratory for multiple failures to implement radiological protection requirements and provide the quality controls necessary to protect workers involved in High Efficiency Particulate Air (HEPA) filter shredding operations. On July 2, 1997, five workers received curium intakes and spread contamination in a laboratory room when they shredded a HEPA filter. The HEPA filter contained approximately 100 mCi of curium, which exceeded the operational safety procedure permissible radiological activity limit of 1 mCi per 7.5 cubic feet by more than 500 times. Lawrence Livermore personnel estimated that one worker received a whole body dose of 15 to 30 rem committed effective dose equivalent and 250 to 500 rem committed dose equivalent to his bone surface. This was at least three times the 5-rem annual limit for the whole body and five times the 50-rem annual limit to the bone surface. The notice also addressed ineffective corrective actions in response to a November 1996 Lawrence Livermore report that identified significant and potentially widespread problems with workers not following operational safety procedures. (NTS Report NTS-SAN--LLNL-LLNL-1997-0001; ORPS Report SAN--LLNL-LLNL-1997-0038; DOE/OAK-540, Rev. 0, "Type B Accident Investigation Board Report of the July 2, 1997, Curium Intake by Shredder Operator at Building 513 Lawrence Livermore National Laboratory, Livermore, California," August 1997; Letter, DOE (P. Brush) to Lawrence Livermore National Laboratory (R. Kuckuck), 03/09/98; Lawrence Livermore National Laboratory Nuclear Facility Safety Appraisal, "Status of FSP and OSP Implementation," 11/96)

Investigators determined that multiple failures occurred in the use of equipment and tools for the shredding process and during work performance. They determined that waste characterization data was available for the shredded HEPA filter, but it was incorrectly identified on the HEPA-filter waste storage box label and on the radioactive waste disposal requisition form. They also determined that no one confirmed the label accuracy or performed radiological surveys or additional characterization of the HEPA filter before it was shredded. On the day of the event, operators opened the HEPA filter box, removed the protective plastic from the filter, roughed-up the filter edges using a hand-held electric reciprocating saw, and shredded the filter. Investigators determined that no one performed radiological surveys or swipes to assess filter contamination levels after removing the filter plastic. They also determined that someone had turned off the room's continuous air monitor alarm, and no warning was available when airborne contamination in the room reached high levels. In addition, investigators determined that facility personnel modified the shredder ventilation system without following the required review and approval process.

The Office of Enforcement and Investigation staff and DOE Oakland Operations Office personnel conducted an investigation of the event and proposed a Severity Level I violation for exceeding worker dose limits and several Severity Level II violations for failure to implement appropriate work controls and failure to correct previously identified problems. Severity Level I violations are the most significant and involve an adverse impact on safety or high potential for such an impact. Severity Level II violations are significant violations that demonstrate a lack of attention or carelessness toward safety that could potentially lead to adverse impacts.

Lawrence Livermore management has 30 days to reply to the Preliminary Notice of Violation and admit or deny the alleged violations. The Preliminary Notice of Violation will become final if they admit the allegations and provide sufficient corrective actions within the 30-day period. Enforcement actions can be found at the Office of Enforcement and Investigation web site at URL http://tis-nt.eh.doe.gov/enforce/.

Under the provisions of the Price-Anderson Amendments Act, DOE can fine contractors for violations of Department rules, regulations, and compliance orders relating to nuclear safety requirements. DOE contractors who operate nuclear facilities and fail to implement corrective actions for identified deficiencies could be subjected to Price-Anderson civil penalties under the work processes and quality improvement provisions of 10 CFR 830.120, *Quality Assurance Requirements*. These actions include Notices of Violation and, where appropriate, non-reimbursable civil penalties. The primary consideration for determining whether DOE takes enforcement action is the actual or potential safety significance of the violation, coupled with how quickly the contractor acts to identify and correct problems. The Office of Enforcement and Investigation may reduce penalties when a DOE contractor promptly identifies a violation, reports it to DOE, and undertakes timely corrective action. DOE has discretion to not issue a Notice of Violation in certain cases. The Noncompliance Tracking System (Weekly Summaries 95-17 and 95-20) provides a means for contractors to promptly report potential noncompliances and take advantage of provisions in the enforcement policy. DOE STD-7501-95, *Development of DOE Lessons Learned Programs*, discusses management responsibility for incorporating appropriate corrective actions in a timely manner.

In August 1997, DOE issued DOE/OAK-540, Rev. 0, “Type B Accident Investigation Board Report of the July 2, 1997 Curium Intake by Shredder Operator at Building 513 Lawrence Livermore National Laboratory, Livermore, California.” This report concluded that (1) Hazardous Waste Management failed to properly analyze hazards for shredding waste and establish appropriate procedures or controls for defense in depth, (2) supervision and management failed to provide adequate oversight to ensure procedural compliance, (3) Hazardous Waste Management failed to accurately characterize waste, and (4) Lawrence Livermore management failed to adequately disseminate waste characterization and hazard knowledge between organizations. These conclusions led to the development of several judgments of need. Following are some of the judgments of need.

- Hazardous Waste Management should establish procedures to ensure that appropriate analyses are performed and reviewed before beginning work and should ensure that operations are completely analyzed and controlled.

- Hazardous Waste Management should improve compliance enforcement through existing procedures; increase management involvement in operations assessments; and ensure personnel are trained in procedures, safety equipment, and alarm usage.

- Lawrence Livermore management should evaluate waste characterization program effectiveness, identify errors, and determine corrective actions where appropriate.

- Lawrence Livermore management should develop and implement mechanisms to share waste characterization and hazard data.

NFS reported issuance of Notices of Violations under the Price-Anderson Amendments Act in Weekly Summaries 97-52, 97-41, 97-29, 97-12, 97-02, 97-01, 96-43, and 96-30.

KEYWORDS: radiation protection, ALARA, enforcement, Price-Anderson Act

FUNCTIONAL AREAS: Radiation Protection

OEAF FOLLOW-UP ACTIVITIES

1. CORRECTION TO WEEKLY SUMMARY 98-09, ARTICLE 3

Article 3 in Weekly Summary 98-9 incorrectly stated that the forced ventilation required in the Radiological Work Permit section of the work package was necessary to mitigate worker exposure if thorium became airborne as a result of worker activity inside the tank. The article should have said that ventilation was required to mitigate worker exposure to odors that are known to arise when sludge is disturbed. Other personal protective equipment requirements were in force and were properly used to mitigate worker exposure to airborne contaminants.

KEYWORDS: confined space, radiological work permit

FUNCTIONAL AREAS: Industrial Safety, Training and Qualification